

CLAIMS

What is claimed is:

1. A method of making a radio frequency identification (RFID) device, the method comprising:
forming a conductive seed layer on a substrate; and
attaching a strap to the substrate, wherein the attaching includes crimping to form crimped electrical connections between the seed layer and conductive leads of the strap.
2. The method of claim 1,
wherein the conductive seed layer is formed on a first face of the substrate;
wherein the strap is attached on a second face of the substrate that is on an opposite side from the first face; and
wherein the crimped electrical connections pass through the substrate.
3. The method of claim 1, wherein the strap is attached on the same side of the substrate as the conductive seed layer.
4. The method of claim 1, further comprising, after the attaching, plating on the seed layer to form a conductive pattern.
5. The method of claim 4; wherein the plating includes adding conductive plating material to the crimped electrical connections.
6. The method of claim 5, wherein the adding material includes thickening at least portions of the crimped connections.
7. The method of claim 5, wherein the adding material includes filling gaps between the crimped connections and the conductive leads.

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8. The method of claim 5, wherein the adding material includes filling gaps between the crimped connections and the seed layer.

9. The method of claim 4, wherein the plating includes coupling the conductive leads to the seed layer.

10. The method of claim 1, wherein the crimping includes piercing the conductive leads, the substrate, and the seed layer, thereby displacing conductive material of the conductive leads and bringing the conductive material into contact with the seed layer.

11. The method of claim 10, wherein the crimping further includes forming crowns from the displaced conductive material, wherein the crowns are in contact with portions of the seed layer, thereby securing the strap to the substrate.

12. The method of claim 11, further comprising, after the attaching, plating on the seed layer to form a conductive pattern.

13. The method of claim 12, wherein the plating includes adding conductive plating material to the crimped electrical connections.

14. The method of claim 10,
wherein the conductive seed layer is formed on a first face of the substrate;
wherein the strap is attached on a second face of the substrate that is on an opposite side from the first face; and
wherein the crimped electrical connections pass through the substrate.

15. The method of claim 10, wherein the strap is attached on the same side of the substrate as the conductive seed layer.

16. The method of claim 10,
further comprising, prior to the crimping, making a hole in the substrate;

wherein the crimping includes placing a portion of the strap into the hole.

17. The method of claim 1, wherein the crimping includes driving a metal rods through the conductive leads, the substrate, and the seed layer.

18. The method of claim 17, wherein the crimping further includes bending ends of the metal rods.

19. The method of claim 18, wherein the bending includes, for each of the rods, bending the ends against the seed layer and respective of the conductive leads.

20. The method of claim 17, further comprising, after the attaching, plating on the seed layer to form a conductive pattern.

21. The method of claim 20, wherein the plating includes adding conductive plating material to the crimped electrical connections.

22. The method of claim 17,
wherein the conductive seed layer is formed on a first face of the substrate;
wherein the strap is attached on a second face of the substrate that is on an opposite side from the first face; and
wherein the crimped electrical connections pass through the substrate.

23. The method of claim 1, wherein the crimping includes:
making slits in the substrate and the seed layer;
passing the conductive leads of the strap through the slits; and
bending ends of the conductive leads that have been passed through the slits.

24. The method of claim 1, wherein the forming the seed layer includes depositing a conductive layer on the first face.

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25. The method of claim 24, wherein the depositing includes vacuum deposition of a conductive material.

26. The method of claim 25, wherein the vacuum deposition includes vacuum deposition of copper.

27. The method of claim 25, wherein the depositing includes depositing the conductive material to a thickness of about 10,000 Angstroms or less.

28. The method of claim 24, further comprising forming a patterned dielectric mask layer over the conductive layer.

29. The method of claim 28, wherein the forming the patterned dielectric mask layer includes patterned printing of a dielectric material.

30. The method of claim 29, wherein the dielectric material is an alkaline-strippable material.

31. The method of claim 29, wherein the dielectric material includes an oil.

32. The method of claim 29, wherein the dielectric material includes a resist material.

33. The method of claim 29, wherein the dielectric material is a soluble material that is soluble in a suitable solvent.

34. The method of claim 28, further comprising, subsequent to the forming the patterned conductive layer, plating on the seed layer to form a conductive pattern.

35. The method of claim 34, further comprising, subsequent to the plating, removing the dielectric layer.

36. The method of claim 1, wherein the forming the seed layer includes printing a conductive ink on the first face of the substrate.

37. The method of claim 35, wherein the printing the conductive ink includes a patterned printing of the conductive ink.

38. A radio frequency identification (RFID) device comprising:
a substrate;
a patterned conductive layer on the substrate;
a strap; and

at least one crimped electrical connection between the strap and the patterned conductive layer.

39. The device of claim 38, wherein the patterned conductive layer and the strap are on opposite respective sides of the substrate.

40. The device of claim 38, wherein the patterned conductive layer and the strap are on the same side of the substrate.

41. The device of claim 38, wherein the at least one crimped connection passes through the substrate.

42. The device of claim 38, wherein the at least one crimped connection includes a rod that passes through the substrate.

43. The device of claim 42, wherein the rod has a pair of bent ends, one of which is in contact with a seed layer that is part of the conductive pattern, and the other of which is in contact with a conductive lead of the strap.

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44. The device of claim 43, wherein the crimped connection also includes plated material.

45. The device of claim 44, wherein the plated material is continuously coupled to plated material that is at least part of the patterned layer.

46. The device of claim 38, wherein the crimped connection includes conductive material displaced from a conductive lead of the strap.

47. The device of claim 46, wherein the crimped connection also includes plated material.

48. The device of claim 47, wherein the plated material is continuously coupled to plated material that is at least part of the patterned layer.

49. The device of claim 38, wherein the patterned conductive layer includes an antenna.

50. The device of claim 38, wherein the strap includes a chip coupled to the conductive leads.